Letters to the Editor

The Board of Editors does not hold itself responsible for opinions expressed in the letters published in this section. The notes containing short reports of original investigations communicated to this section should not contain many figures and should not exceed 500 words in length. The contributions reaching the Secretary by the 15th of any month may be expected to appear in the issue for the next month. No proof will be sent to the author.

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EFFECT OF RESONANCE ON NEUTRON SCATTERING BY CARBON

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Recently Ganguly and Sil (1963) have obtained the elastic scattering cross-section of neutrons by C^{12} at 4.1 and 2.7 Mev energy (laboratory system) by calculating the phases by the Brysk (1962) method with a complex potential of Woods-Saxon (1954) form. As the agreement of theoretical results with experimental values was not good, we have recalculated the same problem taking into account the resonance level of the C^{13} nucleus at 3.38 Mev (centre of mass system) which has the width $\Gamma = 1$ Mev (Landolt-Börnstein, 1961), we have neglected other resonances as their widths are much less compared with the above. As the level ascribed to it is $D_{3/2}$ the phase shift corresponding to this level will be, according to Breit-Wigner formula, changed to

$$\delta_{3/2,2} = \delta^{\circ}_{3/2,2} + \tan^{-1}[\Gamma/2(E_R - E)]$$

where $\delta^0_{3/2,2}$ is the ordinary phase shift without the resonance effect. E_R and E are respectively the energies of the resonance level and the incident particle expressed in C.M. system. E in C.M. system will be 3.77 and 2.48 Mev corresponding to energies 4.1 and 2.7 Mev in the Laboratory system.

The phases of Ganguly and Sil (1963) did not depend on spin, as such they were lebelled as δ_0, δ_1 and δ_2. Now in view of the fact that the resonance level depends on the spin value, we rewrite the previous phases as $\delta_0 \rightarrow \delta_{1/2,0}$,

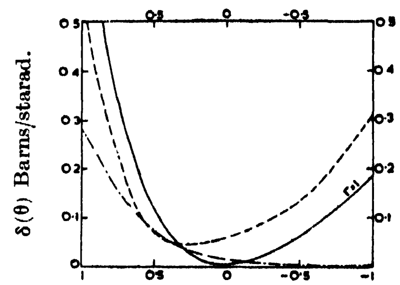
$\delta_1 \rightarrow \delta^0{}_{1/2,1} = \delta^0{}_{3/2,1}$ and $\delta_2 \rightarrow \delta^0{}_{5/2,2} = \delta^0{}_{3/2,2}$. Because of the resonance, only the phase $\delta_{3/2,2}$ gets changed as follow :

Energy E	$\tan \delta^0{}_{3/2,2}$	$\tan \delta_{3/2,2}$
3.77	$-0.1092+0.0036\,i$	$-1.6223+.0129\,i$
2.48	$-0.0340+0.0012\,i$	$+0.5126+.0016\,i$

Neglecting contribution from partial waves with $l > 2$ we may write the expression for the scattering cross-section (vide Wu and Ohmura, 1962) as

$$\sigma(\theta) = K^{-2}\,|\,A_0+3A_1 \cos\theta+(3A_2+2A'_2)P_2(\cos\theta)\,|^2+K^{-2}\,|\,A_2-A'_2\,|^2.9 \sin^2\theta \times \cos^2\theta,$$

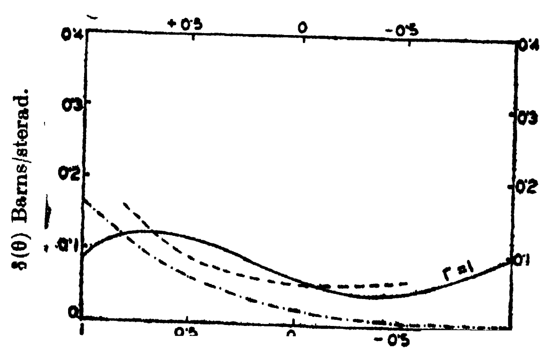
where $$A_l = \frac{\tan\delta_l}{1-i\tan\delta_l}\,,\ l = 0, 1 \text{ and } 2;\quad A'_2 = \frac{\tan\delta_{3/2,2}}{1-i\tan\delta_{3/2,2}}\,.$$



Cos θ C. M. system.

Fig. 1. Elastic scattering of 4.1 Mev neutrons by C^{12}. The solid curve represents the theoretical results due to the inclusion of the effect of the resonance level ; the dash-dot-dash curve is the theoretical findings of Ganguly and Sil and the dashed curve is the experimental results of Walt and Beyster.

The results as obtained are compared with experimental values (Walt and Beyster, 1955; Little *et al.*, 1955) in Figs. 1 and 2. The agreement for the case of



Cos θ C. M. system.

Fig. 2. Elastic scattering of 2.7 Mev neutrons by C^{12}. The notations are the same as those of Figure 1. Experimental results are due to Little *et. al*,

3.77 Mev is good but for 2.48 Mev it is not so particularly at small angles of scattering.

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